

CS726, Fall 2008

Homework 1 (due Friday 9/12/08 at start of class)

1. (a) Give an example of a matrix that is *not* positive definite despite having all positive entries.
(b) If A is a positive definite matrix, must its diagonal elements all be positive? Explain.
2. Show that the scalar sequence starting with $x_1 = .01$ and defined by $x_{k+1} = 20x_k^2$ converges Q -quadratically to 0.
3. For the following problems, write down their equivalent linear programming formulations, if possible (introducing additional variables as necessary), *or* explain why they cannot be formulated as linear programs.

(a)

$$\min_x c^T x + \|x\|_1 \quad \text{such that } Cx \geq d.$$

(b)

$$\min_{x_1, x_2} \max(3x_1 + 2x_2 - 5, 2x_1 - x_2 - 2) \quad \text{s.t. } x_1 + x_2 \leq 7, x_1 \geq 0, x_2 \geq 0.$$

(c)

$$\min_{x_1} \min(2x_1 + 5, -x_1 + 8) \quad \text{s.t. } |x_1| \leq 10.$$

(d)

$$\min_{x \in \mathbf{R}^2} c^T x \quad \text{subject to } \|x\|_1 \leq 5, \|x\|_\infty \geq 1.$$